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CONTRACT NO. DAAA15-90-D-0017  
Delivery Order 0002  
Document No. SFIM-AEC-CR-98038

**FINAL  
PROPOSED REMEDIAL ACTION PLAN FOR THE  
LF2/SARN/38-ACRE PARCEL FILL AREA  
OF THE SURPLUS OPERABLE UNIT,  
FORT SHERIDAN, ILLINOIS**

**March 1, 1999**

19991108 019

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**Prepared for:**

**U.S. ARMY ENVIRONMENTAL CENTER  
Base Closure Division  
Aberdeen Proving Ground, Maryland 21010-5401**

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# REPORT DOCUMENTATION PAGE

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1. AGENCY USE ONLY (Leave blank)	2. REPORT DATE	3. REPORT TYPE AND DATES COVERED Proposed Plan 1/99 - 3/99	
4. TITLE AND SUBTITLE  Final Remedial Action Plan for the LF2/SARN/38-Acre Parcel Fill Area, Fort Sheridan, Illinois			5. FUNDING NUMBERS  DAAA15-90-D-0017 Delivery Order 0002
6. AUTHOR(S)  Deborah McKinley, James Kountzman, and Ann Shortelle			
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)  QST Environmental 11665 Lilburn Park Road St. Louis, Missouri 63146		8. PERFORMING ORGANIZATION REPORT NUMBER  490-2087-1000	
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)  U.S. Army Environmental Center Base Closure Division Attn: SFIM-AEC-BCA Edgewood Area Building E-4480 Aberdeen Proving Ground, Maryland 21010-5401		10. SPONSORING/MONITORING AGENCY REPORT NUMBER  SFIM-AEC-RP-CR-98038	
11. SUPPLEMENTARY NOTES			
12a. DISTRIBUTION/AVAILABILITY STATEMENT  Distribution unlimited. Approved for public release.			12b. DISTRIBUTION CODE
13. ABSTRACT (Maximum 200 words)  This document presents a summary of the Remedial Investigation findings and Baseline Risk Assessment conclusions for the LF2/SARN/38-Acre Parcel Fill Area, Fort Sheridan, Illinois. The Proposed Plan also presents the selected remedial alternative for the LF2/SARN/38-Acre Parcel Fill Area. The selected remedy is No Action. The absence of risk outside the target risk range (i.e., 1E-06 - 1E-04) is the basis for selection of the No Action remedy.			
14. SUBJECT TERMS  Fort Sheridan, Landfill 2, SARN, 38-Acre Parcel Fill Area, Proposed Plan			15. NUMBER OF PAGES 34
			16. PRICE CODE
17. SECURITY CLASSIFICATION OF REPORT  Unclassified	18. SECURITY CLASSIFICATION OF THIS PAGE  Unclassified	19. SECURITY CLASSIFICATION OF ABSTRACT  Unclassified	20. LIMITATION OF ABSTRACT  UL

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**Final Proposed Remedial Action  
Plan for the Landfill 2/Small Arms  
Range North/38-Acre Parcel Fill  
Area of the Surplus Operable Unit,  
Fort Sheridan, Illinois**

Prepared for:  
U.S. Army Environmental Center  
Edgewood Area  
Aberdeen Proving Ground, Maryland

Prepared by:  
QST Environmental Inc.  
St. Louis, Missouri

March 1, 1999

QST Project No. 490-2087-1000

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Appendix A	Glossary of Terms
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**Table of Contents (continued)****List of Abbreviations and Acronyms**

B172	Building 172
BRA	Baseline Risk Assessment
BRAC	Base Realignment and Closure
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
COPC	constituent of potential concern
DoD	Department of Defense
EQ	ecotoxicity quotient
ft-bgs	feet below ground surface
HI	Hazard Index
IEPA	Illinois Environmental Protection Agency
LF2	Landfill 2
MDL	method detection limit
NEPA	National Environmental Policy Act of 1969
NPL	National Priority List
OU	Operable Unit
PAH	polynuclear aromatic hydrocarbon
RAE	reasonable average exposure
RI/BRA	Remedial Investigation/Baseline Risk Assessment
RI/FS	Remedial Investigation/Feasibility Study
RME	reasonable maximum exposure
SARA	Superfund Amendments and Reauthorization Act
SARN	Small Arms Range North
USAEC	U.S. Army Environmental Center
USC	United States Code
USEPA	U.S. Environmental Protection Agency

## 1.0 Introduction

The Proposed Remedial Action Plan for the Landfill 2/Small Arms Range North/ 38-Acre Parcel Fill Area (LF2/SARN/38-Acre Parcel Fill Area) of the Surplus Operable Unit (OU) (Proposed Plan) identifies the **Preferred Alternative** for this area. After completing a comprehensive environmental investigation of LF2, SARN, and the 38-Acre Parcel Fill Area study areas, the Army is recommending that no action is necessary at these study areas. This Proposed Plan describes the rationale used to determine that no action is needed. This document is being issued by the Army, the lead agency for remedial activities, in consultation with the U.S. Environmental Protection Agency (USEPA) and the Illinois Environmental Protection Agency (IEPA), which are the support agencies for this site. Following review and consideration of the information submitted during the public comment period (TBD), the Army, in consultation with the USEPA and IEPA, will select the final remedy for the LF2/SARN/38-Acre Parcel Fill Area in a **Decision Document**.

Throughout this document, key words will be printed in **bold** type. Definitions for these key words can be found in Appendix A, Glossary of Terms.

The Army is issuing this Proposed Plan in accordance with the public notification requirements under Sections 113(k)(2)(B), 117(a), and 121(f)(1)(G) of the **Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of 1980**, as amended by the **Superfund Amendments and Reauthorization Act of 1986 (SARA)**; 42 United States Code (USC) §§ 9613(k)(2)(B), 9617(a), and 9621(f)(1)(G); Army Regulation 200-1, Chapter 9-11(b)(4); Army Regulation 200-2, Section 2-2; and the National Environmental Policy Act (NEPA) of 1969.

The Proposed Plan for the LF2/SARN/38-Acre Parcel Fill Area highlights information that can be found in greater detail in the **LF2/SARN/38-Acre Parcel Fill Area Remedial Investigation/Baseline Risk Assessment (RI/BRA)**. The RI/BRA, as well as other documents related to environmental investigations at Fort Sheridan, can be found at the **Information Repositories** listed below. The Army encourages the public to review these documents to gain a more comprehensive understanding of the environmental activities at Fort Sheridan. The complete **Administrative Record File**, which contains all of the information used to propose No Response Action for the LF2/SARN/38-Acre Parcel Fill Area, is located at the Fort Sheridan Base Realignment and Closure (BRAC) Office. Information contained in the Information Repositories is similar to that contained in the Administrative Record, but is more focused on public information needs.

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Sunday Closed

Fort Sheridan BRAC Office\*  
Building 379  
Fort Sheridan, Illinois 60037-1289  
Phone: 847/266-6323  
Hours: Mon.-Fri. 8:30 am - 5:00 pm  
Sat.-Sun. Closed

\* Location of Administrative Record

The public comment period will begin on March 3, 1999. A public information session will be held on March 3, 1999 from 8:00 pm to 9:00 pm at Fort Sheridan's Building 900. At this session, the Army will present the findings of the RI/BRA, summarize the Proposed Plan's No Response Action alternative, and describe the rationale for that recommendation. Army representatives will be available to answer questions and collect public comments that night. Further written comments may be submitted until April 1, 1999 by fax to 847/266-3905 or mail to:

Fort Sheridan BRAC Office  
ATTN: LF2/SARN/38-Acre Parcel Fill Area Proposed Plan  
3155 Blackhawk Drive, Suite 17  
Fort Sheridan, IL 60037-1289

Comments received during the public comment period will be considered by the Army, in consultation with the USEPA and IEPA, prior to making the final decision in the Decision Document. Therefore, the Army, USEPA, and IEPA encourage the public to review and comment on both the supporting documentation included in the Administrative Record File and the site-related documents contained in the information repositories. The Army will address these public comments in a **Responsiveness Summary**, to be attached as an appendix to the Decision Document.

## 2.0 Site Background

In 1988, the Commission on BRAC recommended Fort Sheridan, Illinois for closure to the Secretary of Defense. To support decisions regarding preparation of the property for release, the Department of the Army has implemented environmental studies and will conduct restoration activities (if needed) before property transfer. The Army is conducting these activities under the Defense Environmental Restoration Program and the BRAC Program. A **remedial investigation/feasibility study (RI/FS)** is currently being conducted for the Surplus OU at Fort Sheridan. The Surplus OU consists of property that has been declared excess by the Army and will be transferred to the local communities (Figure 2-1). Portions of the Surplus OU have already been transferred. The LF2/SARN/38-Acre Parcel Fill Area was segregated from the remaining untransferred portions of the Surplus OU in order to evaluate a previously unidentified area of disposed material in the 38-Acre Parcel. This Proposed Plan addresses only the LF2, SARN, and 38-Acre Parcel Fill Area study areas of the Surplus OU (Figure 2-2).

### 2.1 Site Description and Summary of Environmental Investigations

LF2 is located in and proximal to a former northern branch of Hutchinson Ravine in the northeastern portion of Fort Sheridan in the Surplus OU. LF2 was used prior to World War I (ANL, 1989). At that time, small arms firing ranges (SARN) were constructed over and adjacent to LF2. The ranges have not operated since the 1950s. There are no longer any surface expressions of the actual target berms. The berms were probably leveled during the Haley Army Airfield runway construction in 1953. The exact dates and types of refuse disposed of at LF2/SARN are uncertain; however, excavation activities in the area have uncovered coal, cinders, and concrete construction debris. There were also reports that the 51st Explosive Ordnance Detachment disposed of ammunition at LF2 by detonation in a pit dug for that purpose (ANL, 1989). Data from the soil borings and test pits completed at LF2/SARN have demonstrated that while the soil at the study area is disturbed to a depth of approximately 2 to 3 feet below ground surface (ft-bgs), the actual landfilling/disposal area is limited to the small northern branch of Hutchinson Ravine (Figure 2-3). There is no storm sewer associated with LF2.

The 38-Acre Parcel Fill Area study area is located immediately west of the LF2/SARN study area within the western portion of fence line in what is commonly referred to as the 38-Acre Parcel. Excavation activities by the Lake County Forest Preserve District in support of the future Golf Course Club House construction uncovered metallic debris, wire, nails, cinders, and occasional items such as paint cans in the southeast portion of the 38-Acre Parcel. Because this fill area is located in the 38-Acre Parcel, the study area is referred to as the 38-Acre Parcel Fill Area. The 38-Acre Parcel Fill

Area did not appear on historical aerial photographs as a disturbed area and was not identified in any previous environmental assessments. Other fill/waste material encountered during investigation activities consisted of various amounts of ash, coal, concrete, brick, tile, ceramic, bone, wood, metal debris, and glass bottles. It appears that this fill/waste is from the early 1900s (based on types of bottles and other dated waste found). The presence of organic rich clay (i.e., containing fibrous plant material and decayed vegetation) beneath the waste observed in the 38-Acre Parcel Fill Area suggests that a low lying marshy area was filled with trash from either early base operations or pre-Fort Sheridan activities. On the whole, the waste appears to be typical of what one would expect a military dining hall or private eating establishment of that era to generate (i.e., broken pottery and ceramic plates, bottles of various types, animal bones, etc). This fill/waste is distinctly different from the waste found at LF2/SARN and appears to have been disposed of decades before the filling of the ravine that now constitutes LF2. The extent of the fill/waste is shown in Figure 2-4.

A Phase I RI was conducted at Fort Sheridan from 1990 through 1992. **Unexploded ordnance (UXO)** avoidance surveys were conducted at the LF2/SARN study area to identify potential UXO in the area designated for surface and subsurface investigation and geophysical surveys of LF2 to delineate the landfill boundaries. Fifteen soil borings (14 of which were converted into monitoring wells) were completed at LF2. Two monitoring wells were installed upgradient of LF2. Twelve monitoring wells were installed along the beach at six well nests of one deep well and one shallow well. Soil samples were collected from 9 of the 15 soil borings (soil samples were not collected from the shallow borings at each well nest location). Subsequent to the installation of the LF2 monitoring wells, one round of groundwater samples was collected.

The Phase II field effort was conducted from October 1995 through June 1996. During this field effort, UXO avoidance surveys were conducted at LF2 in areas designated for surface and subsurface investigation and five soil borings and three test pits were completed. Two soil borings were subsequently converted into monitoring wells. Soil samples were collected from each of the soil boring and test pit locations at LF2. In addition, soil samples were collected from six soil boring locations at SARN. Two rounds of groundwater samples were collected from the existing monitoring wells at LF2.

During the Phase III field effort conducted in the fall of 1996, animal tissue sampling was conducted to support the ecological BRA. Specifically, tissue sampling of earthworms was conducted at LF2/SARN and within the fenced area commonly referred to as the 38-Acre Parcel. Earthworms were also collected from a background area.

As mentioned previously, excavation activities performed in 1997 by the Lake County Forest Preserve District uncovered a previously unidentified area of disposed material in the 38-Acre Parcel. Consequently, a Phase IV RI was performed at the 38-Acre Parcel Fill Area in February and March 1998. The investigative effort consisted of excavating 46 individual test pits. Surface and subsurface soil samples were collected from 18 of the test pits. In addition, two surface soil samples were collected at LF2/SARN to further evaluate the presence of lead.

The following sections present the data collected during the RI to determine the nature and extent of the constituents detected in samples collected from the LF2/SARN/38-Acre Parcel Fill Area. Given that more than 150 separate constituents were analyzed and that the majority of the constituents were reported as not detected, an exhaustive presentation of the presence or absence of each constituent would be inefficient and, in many cases, would provide an excess of irrelevant information that would only serve to confuse the presentation. Therefore, to facilitate the presentation of the RI results, the following sections will focus on benzo(a)pyrene, **total carcinogenic polynuclear aromatic hydrocarbons (PAHs)**, total chlordane, p,p'-DDD, p,p'-DDT, arsenic, chromium, and lead. Total carcinogenic PAHs represent the sum of benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene, dibenzo(a,h)anthracene, and indeno(1,2,3-cd)pyrene. These constituents, plus the **metals (inorganics)** previously mentioned, tend to be the primary risk drivers from a risk assessment perspective. Additionally, the distribution of these constituents in the LF2/SARN/38-Acre Parcel Fill Area is generally representative of the distribution of the other detected constituents.

## 2.2 LF2/SARN

When LF2/SARN was initially identified as a study area, available information indicated that prior activities at the site included the filling of a small northern arm of Hutchinson Ravine with material of an undetermined nature and the burning and disposal of off-specification munitions and possibly UXO. The study area also includes the target area for the small arms range and a portion of the impact area for the former mortar range. Given its history of use and the fact that aerial photographs show that the area around LF2 has been disturbed or relatively unvegetated from the earliest photos through the 1960s, it was presumed that the LF2/SARN study area had the potential to be a significant source of constituents of concern. However, the four phases of investigation performed at the study area have not confirmed these suspicions. The soil borings and test pits at LF2/SARN have demonstrated that, while the soil at the entire LF2/SARN study area has been reworked to a depth of approximately 2 to 3 ft-bgs, the actual landfilling/disposal area is limited to the small filled northern branch of Hutchinson Ravine (see Figure 2-3). The nature of the disposed material is building rubble (i.e., earthen fill, chunks of concrete, rebar, and some metal pipe).

Surface soil analytical data indicate that arsenic and chromium were generally not detected at concentrations above their **background** comparison values at LF2/SARN. There is a noticeable cluster of lead detections significantly above the background comparison value in the surface soil samples proximal to the central and southern former SARN target berm locations. It is likely that these soil samples were collected from the area where the former target berms were leveled out. Benzo(a)pyrene and/or total carcinogenic PAH concentrations above background comparison values were detected in a few surface soil samples collected on the southern portion of LF2/SARN. The origin of these PAHs may be from the former burning of trash or other materials. In addition, some pesticides/herbicides were detected at relatively low concentrations, albeit above background comparison values, in a few surface soil samples.

Subsurface soil analytical data indicate that arsenic and chromium were generally not detected at concentrations above background comparison values in samples collected from LF2/SARN. Lead, benzo(a)pyrene, total carcinogenic PAHs, and pesticide/herbicide concentrations detected in subsurface soil samples were generally below their respective background comparison values. Lead, total carcinogenic PAHs, and pesticide/herbicide concentrations detected in "waste" soil samples (i.e., earthen fill, chunks of concrete, rebar, and some metal pipe) were generally above background comparison values.

Groundwater analytical data indicate that total arsenic, chromium, and lead concentrations exceeded background comparison values in most of the LF2/SARN samples collected in Round 1 and/or Round 2. Although background comparison values were not calculated for dissolved arsenic, chromium, or lead, the data for these constituents from the same rounds of groundwater sampling were either below **method detection limits (MDLs)** (chromium) or below concentrations detected in the background wells. Benzo(a)pyrene and/or total carcinogenic PAHs were detected in several of the groundwater samples collected from the monitoring wells downgradient of (to the east of) LF2/SARN on the Lake Michigan shoreline. The potential source of these PAHs is the former burning and disposal of trash at LF2/SARN. A few pesticides/herbicides were detected in a few of the groundwater samples collected from LF2/SARN at relatively low concentrations, albeit above background comparison values. In addition, 2,4-DNT and 4-amino-2,6-DNT were detected at low concentrations (i.e., within 10 times the MDL) in Round 1 groundwater samples collected from monitoring wells LF2MW08D and LF2MW11, respectively. It was thought these explosive-related constituents in groundwater may be related to the burning of off-specification munitions at LF2/SARN and/or SARN being an impact area. However, the fact that the detections were not confirmed in Round 2 and these constituents were not detected in Phase I samples suggests that the data may have been anomalous or at least that LF2/SARN does not represent a significant ongoing source.

Earthworm tissue samples were collected and analyzed from several LF2/SARN locations. Arsenic, chromium, lead, and pesticides/herbicides were not detected in earthworm tissue samples at concentrations exceeding their highest detected respective concentrations in the background data set, with one exception. The exception was lead detected in one earthworm tissue sample at a concentration approximately twice the highest detected concentration in the background data set. Benzo(a)pyrene and total carcinogenic PAHs were not detected above MDLs in the earthworm tissue samples.

The data indicate that the extent of elevated concentrations of constituents of concern at LF2/SARN appears to be limited to the disturbed surface soil near the former target berm locations and the waste material in the filled ravine.

### **2.3 38-Acre Parcel Fill Area**

The nature of disposed materials at the 38-Acre Parcel Fill Area was investigated using test pits. Of the 46 test pits excavated, significant thicknesses (1 or more feet thick) of subsurface fill/waste was only encountered within 10. With the exception of one test pit, these test pits are located on the southeastern portion of the 38-Acre Parcel Fill Area.

Surface soil analytical data indicate that arsenic, chromium, and lead were generally not detected at concentrations above their respective background comparison values. Benzo(a)pyrene and/or total carcinogenic PAHs concentrations above background comparison values were detected in some surface soil samples. In addition, some pesticides/herbicides were detected at relatively low concentrations, albeit above background comparison values, in some surface soil samples.

Subsurface soil analytical data indicate that arsenic and chromium were detected at concentrations slightly above background comparison values in some subsurface soil samples. Lead concentrations moderately exceeded the background comparison values in some subsurface soil samples. Benzo(a)pyrene, total carcinogenic PAHs, and pesticide/herbicide concentrations detected in these subsurface soil samples were generally much lower than in the surface soil and fill/waste samples (most concentrations were below background comparison values).

Subsurface fill/waste analytical data indicate arsenic was detected at concentrations slightly exceeding the background comparison value in two samples. Chromium was not detected in any subsurface fill/waste sample at a concentration exceeding the background comparison value. Lead, benzo(a)pyrene, total carcinogenic PAHs, and some pesticide/herbicide concentrations detected in subsurface fill/waste soil samples were generally above background comparison values.

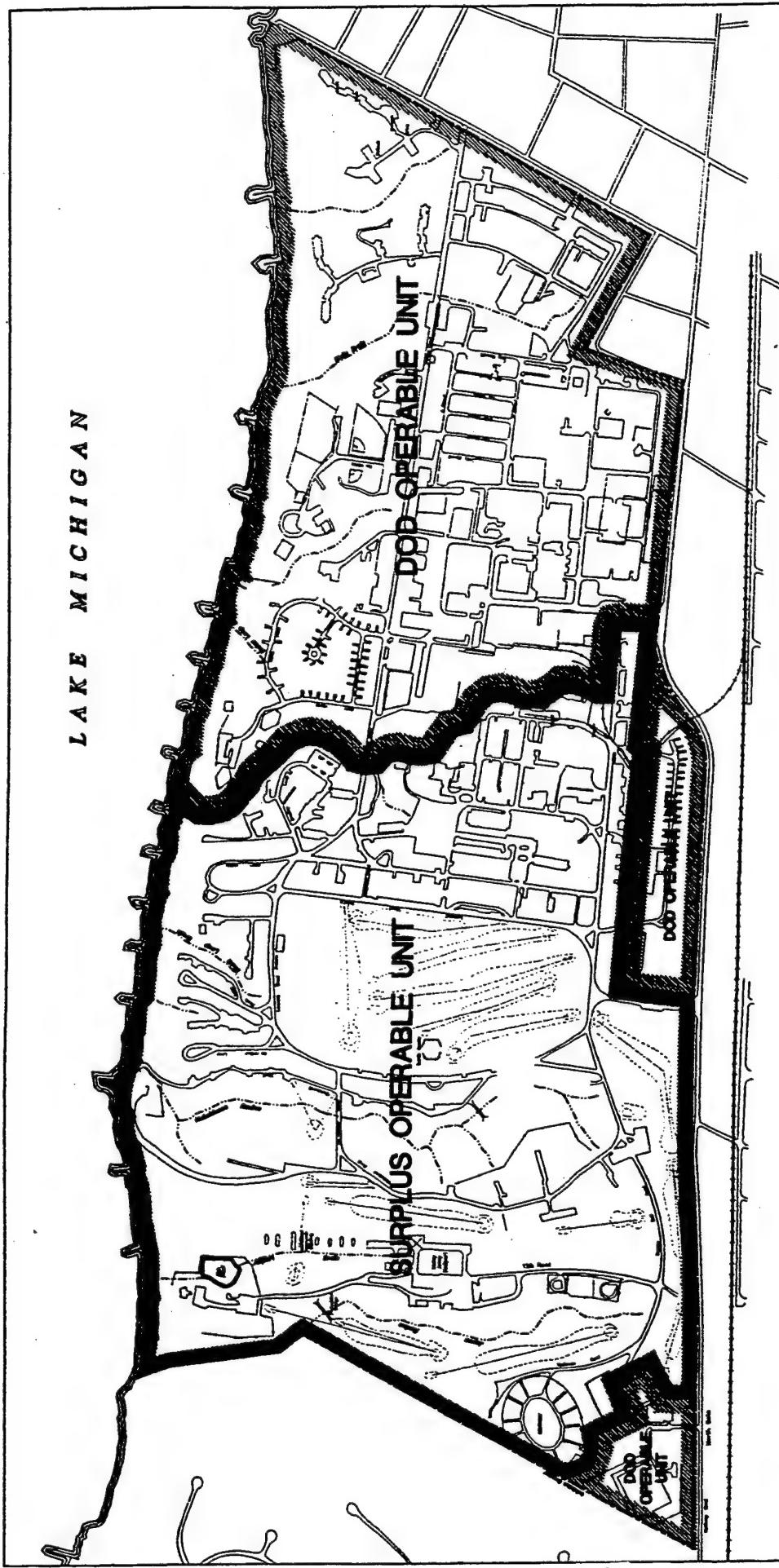
Earthworm tissue samples were collected and analyzed from several locations within the 38-Acre Parcel Fill Area. Arsenic and chromium were the only metals detected in tissue samples at concentration greater than those in the background data set. However, these detections occurred only in one or two samples. Lead and pesticides/herbicides were not detected in earthworm tissue samples at concentrations exceeding their highest detected respective concentrations in the background data set, with one exception. The exception was alpha-chlordane, detected in one earthworm tissue sample at a concentration less than twice the highest detected concentration in the background data set. Benzo(a)pyrene and total carcinogenic PAHs were not detected above MDLs in the earthworm tissue samples.

The extent of elevated concentrations of constituents of concern at the 38-Acre Parcel Fill Area appears to be limited to the disturbed surface soil and the fill/waste material in the southeastern corner of the study area.

## **2.4 Summary of Remedial Investigation Results**

The results of the RI indicate low concentrations of constituents in the soil, groundwater, and earthworm samples collected from the LF2/SARN/38-Acre Parcel Fill Area, with the exception of lead. There is a noticeable cluster of detections of lead significantly above the background comparison value in the surface soil samples proximal to the central and southern former SARN target berm locations. The types of constituents detected generally fall into three categories: metals (inorganics), PAHs, and pesticides. These constituents were used to develop the BRA for the LF2/SARN/38-Acre Parcel Fill Area, which is discussed in the following section (Section 3.0).

L A K E M I C H I G A N



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Adapted from Official Post Map, Directorate of Engineering and Housing, Fort Sheridan, Illinois, January 6, 1989

**Figure 2-1**  
**Fort Sheridan Operable Units**

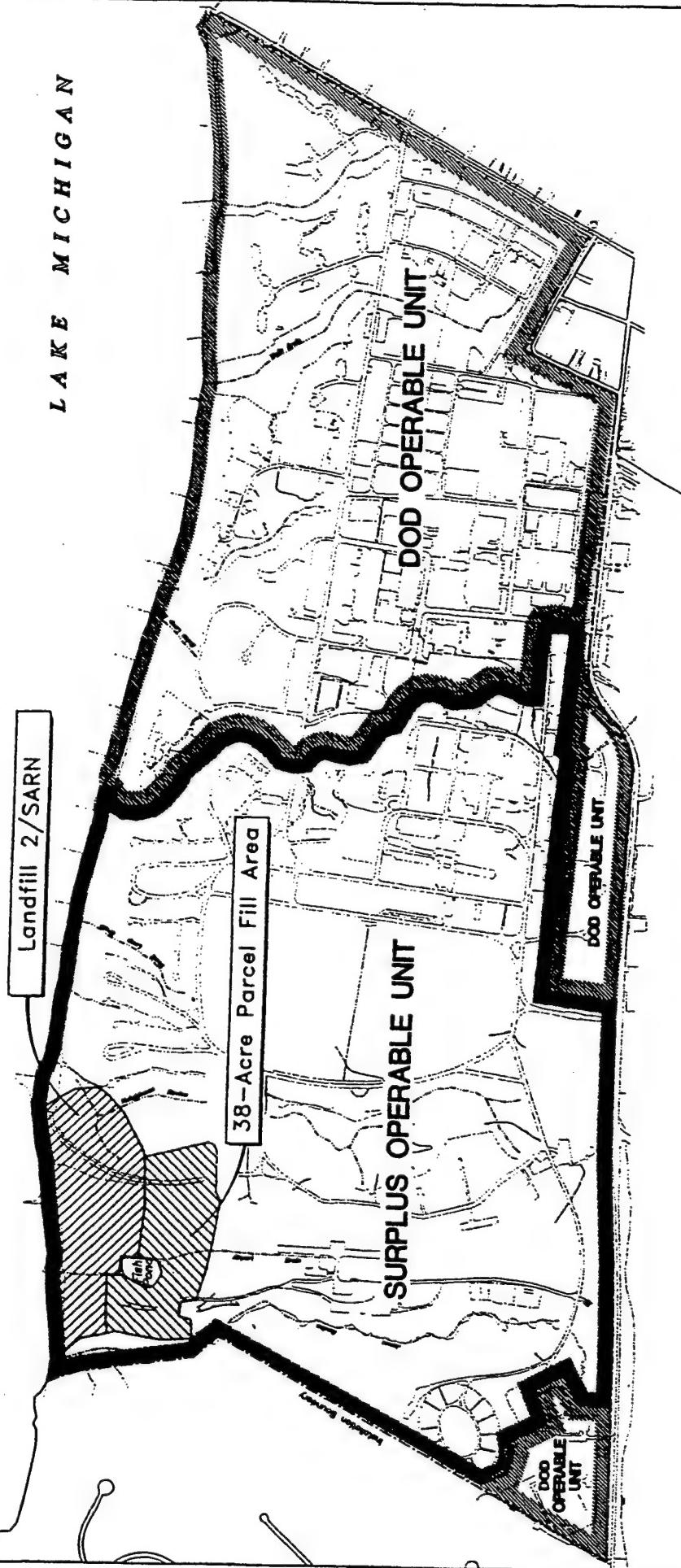
Proposed Remedial Action Plan for the  
LF2/SARN/38-Acre Parcel Fill Area of the  
Surplus Operable Unit

Fort Sheridan, Illinois

**QSK**

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Revised JCF 03/09/98 ~LF340U2

L A K E   M I C H I G A N

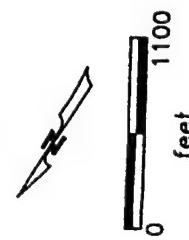


11

Figure 2-2

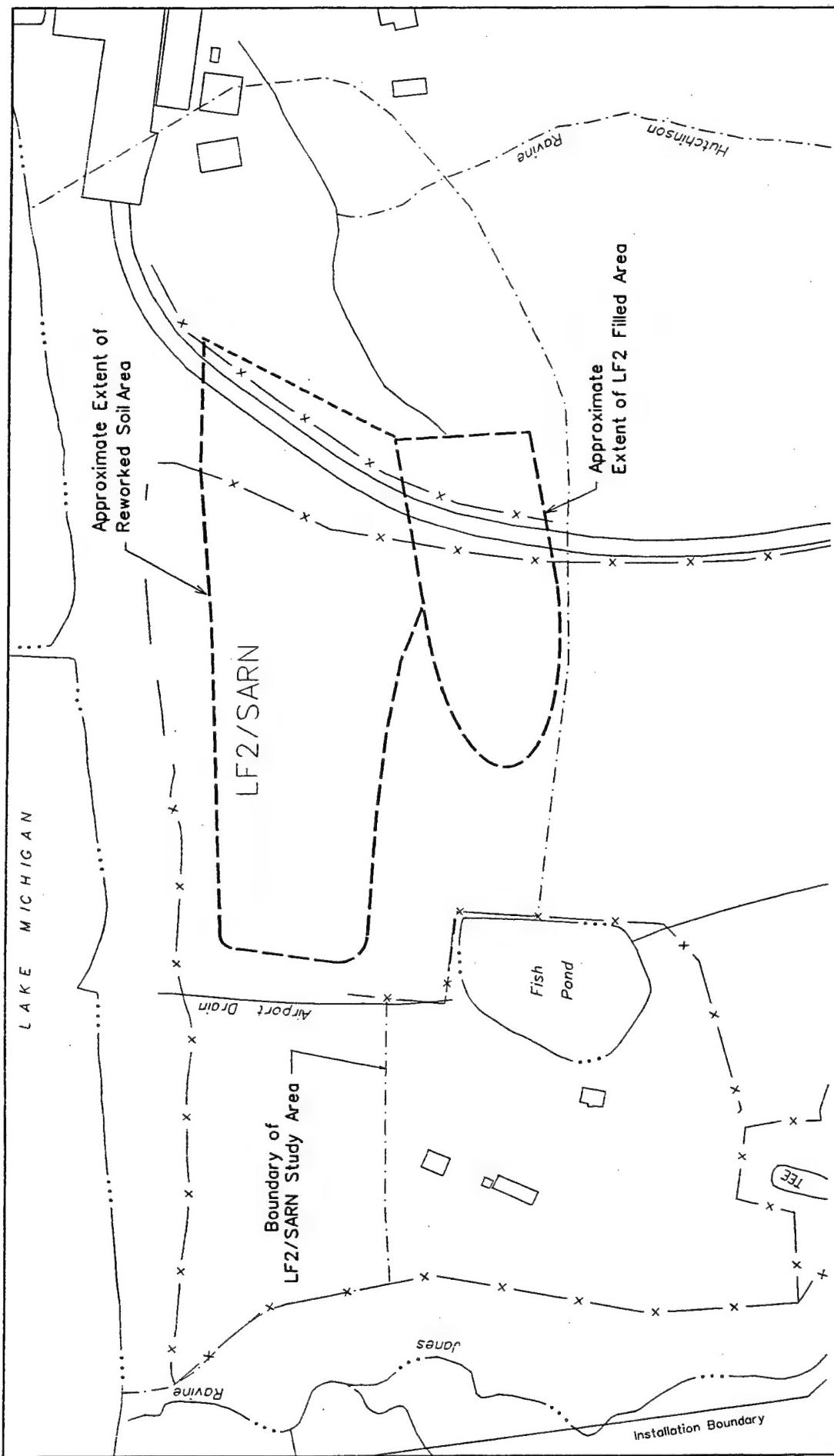
**Landfill 2/SARN and  
38-Acre Parcel Fill Area Locations**  
Proposed Remedial Action Plan for the  
LF2/SARN/38-Acre Parcel Fill Area of the  
Surplus Operable Unit  
Fort Sheridan, Illinois

Adapted from an aerial survey by Air Survey Corporation, Sterling, Virginia. Date of photography: 12/6/95.



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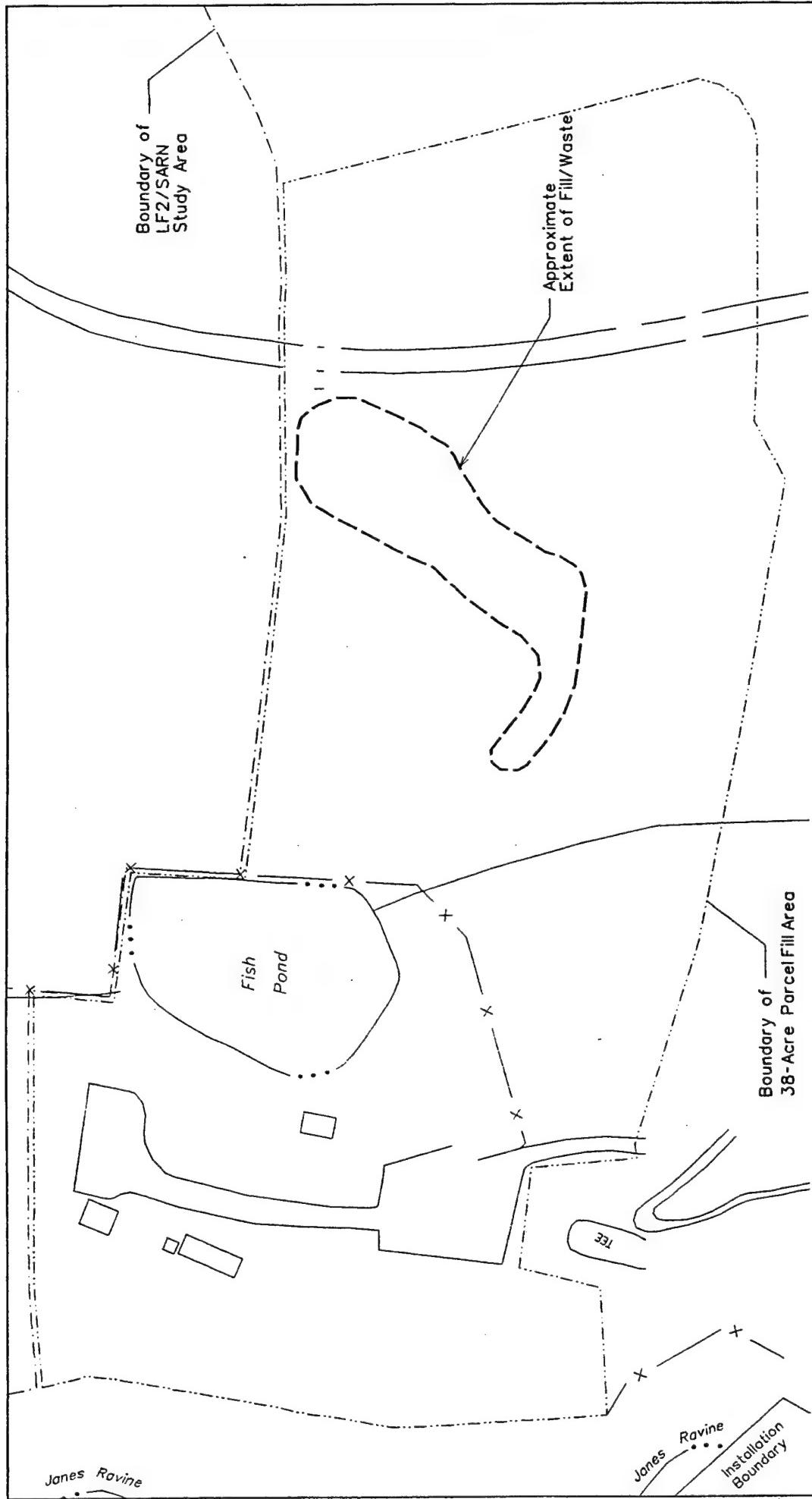
JCF 04/22/98  
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**Figure 2-3  
Approximate Extent of Filled Area at  
Landfill 2/SARN**

Proposed Remedial Action Plan for the  
LF2/SARN/38-Acre Parcel Fill Area of the  
Surplus Operable Unit  
Fort Sheridan, Illinois





**Figure 2-4  
Approximate Extent of Filled Area/Waste at  
the 38-Acre Parcel Fill Area**  
Proposed Remedial Action Plan for the  
LF2/SARN/38-Acre Parcel Fill Area of the  
Surplus Operable Unit  
Fort Sheridan, Illinois

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ENVIRONMENTAL

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## 3.0 Summary of Site Risks

A risk assessment was conducted to determine whether the constituent concentrations detected in the soil, groundwater, and earthworm samples collected during the RI represent a potential risk to human health and/or the environment. This type of analysis is commonly called a baseline risk assessment. If the existing conditions are not found to present a significant risk to human health and/or the environment, remedial actions are not required. If the existing conditions are found to pose an unacceptable risk to human health and/or the environment, then actions must be taken to minimize the risk.

### 3.1 Summary of Human Health Risk Assessment Process

The risk to human health is evaluated by taking into consideration potential exposure to and toxicity of **constituents of potential concern (COPCs)** present at the LF2/SARN/38-Acre Parcel Fill Area. The human health and ecological COPCs evaluated for the LF2/SARN/38-Acre Parcel Fill Area are presented in Table 3-1. The evaluation was performed according to USEPA-approved risk assessment methods (see USEPA, 1989a and 1989b). The USEPA has developed a target risk range that is appropriate for use as a remedial goal for sites similar to the LF2/SARN/38-Acre Parcel Fill Area. For carcinogenic effects, for example, the risk range of one additional chance in 1,000,000 (1E-06) to one in 10,000 (1E-04) that an individual may develop cancer above the expected rate is considered to be acceptable. In general, men have a one in two chance and women have a one in three chance of developing cancer in their lifetime due to generally-occurring, or background, exposures. These chances are called the expected rate. Therefore, the risk assessment estimates the additional chance of developing cancer, above this expected rate. For constituents causing **non-carcinogenic** effects, the likelihood of adverse health effects is expressed as a numerical ratio called the **hazard index (HI)**. The HI identifies the potential for the most sensitive individuals to be adversely affected by site conditions. An HI of one or less is considered acceptable. Both types of risk calculations are performed using conservative (worst case) assumptions about the extent of the COPCs detected and the degree of human exposure to those constituents.

Because the Army will transfer the property represented by the LF2/SARN/38-Acre Parcel Fill Area to the Lake County Forest Preserve District, the risk evaluation took into consideration the future reuses of the property. The legislation adopted in Section 125 of the Fiscal Year 1996 Military Construction Appropriations Act (P.L. 104-32) requires the Army to convey approximately 290 acres of open space, including the existing golf course, to the Lake County Forest Preserve District for use as open space. Therefore, the assumption is that the future use of the LF2/SARN/38-Acre Parcel Fill

Area will be open space. Current access to the LF2/SARN/38-Acre Parcel Fill Area is restricted. Future use of the LF2/SARN/38-Acre Parcel Fill Area is expected to include recreational development as part of an expanded golf course facility. Thus, the BRA includes exposure to future golf course workers and recreational users (golfers), as well as utility or construction workers. The BRA considers how these golfers and workers could come in contact with the COPCs detected in the soil. This is called an **exposure pathway**. There may be several ways within each exposure pathway that a chemical can come into contact with the golfers and/or workers (called **receptors**). This is called an **exposure route**. The exposure routes evaluated are: dermal absorption pathway (i.e., soil contacting the skin); ingestion pathway (i.e., accidental ingestion of soil); and inhalation pathway (i.e., inhalation of dusts from soil). Drinking groundwater was not considered as a likely exposure pathway. The groundwater at Fort Sheridan is not currently used as a drinking water source, and there is an abundant water supply readily available from Lake Michigan. Even if a shallow groundwater well was installed, because of the geology of this site, the well would not yield enough water to support a drinking water or irrigation water supply.

### 3.2 Human Health Risk Assessment

Samples collected during the RI indicate that human health COPCs are present in the LF2/SARN/38-Acre Parcel Fill Area soils at low concentrations, except for a cluster of elevated lead concentrations. These human health COPCs generally fall into two categories: metals (inorganics) and PAHs. These COPCs are present either because of mission-related activities near the study areas or because they are present in the background (Table 3-1). Inorganics are compounds that often occur naturally. However, the inorganic listed in Table 3-1(lead) was detected at levels higher than those detected in the background samples. PAHs are compounds that can be found in oil, ashes, coal, and asphalt paving. PAHs are commonly found in urban areas as a result of road paving, car exhaust, and ashes (leaf/wood burning). However, because PAHs can be hazardous to humans and to the environment, PAHs were included in the risk assessment, regardless of whether they were detected in the background or not.

Under future land use conditions (recreational), the potential **carcinogenic** risk due to the presence of COPCs in the LF2/SARN/38-Acre Parcel Fill Area via all exposure pathways are well below the upper bound of the target risk range (i.e., 1E-04) and, in some cases, are below the lower bound of the target risk range (i.e., 1E-06). The HIs are below the acceptable HI of one in all cases. Under the future land use conditions (recreational), the highest potential risk due to the presence of carcinogenic COPCs in the three study areas via all exposure pathways is 3E-06 or three additional chances in 1,000,000 that an individual may develop cancer over a lifetime of exposure (see "Cancer Risk Level" in Table 3-2). This level is well within the target risk range. The potential risks at the

LF2/SARN/38-Acre Parcel Fill Area are primarily associated with exposure to PAHs. The PAH concentrations detected exceeded the maximum background concentrations by as much as two orders of magnitude (see Tables 3-2 and 3-3).

Because of its uniqueness with regard to toxicity, carcinogenic and noncarcinogenic risks cannot be determined for lead in the same way as for the other LF2/SARN/38-Acre Parcel Fill Area COPCs. Recent toxicological and epidemiological research indicates that lead exhibits a range of adverse effects at low exposure levels; does not appear to have a threshold level below which no adverse health effects occur; and may be carcinogenic at high exposure levels.

The analysis of lead exposure and risk associated with the LF2/SARN/38-Acre Parcel Fill Area involves the development of site-specific risk based remediation goals (RBRGs) for lead. Site-specific RBRGs were developed for each adult exposure scenario evaluated in the BRA (i.e., recreational, maintenance worker, and construction worker).

The evaluation of lead exposure and risk associated with the LF2/SARN/38 Acre Parcel Fill Area consists of a comparison of the lead concentrations in samples collected from the area with the calculated site-specific RBRGs. For children, the soil concentrations were compared to the USEPA soil cleanup guidance level of 400 mg/kg (USEPA, 1994), protective of childhood residential soil exposures. For adults, the soil concentrations were compared to the calculated site-specific RBRGs. The results of this analysis are presented in Table 3-4. The range of soil concentrations at the LF2/SARN/38-Acre Parcel Fill Area for children and for the adult recreational and maintenance worker are well below the levels of concern presented in the table. Although the construction worker soil concentration is above the site-specific RBRG, the lead concentrations present at the LF2/SARN/38-Acre Parcel Fill Area do not pose an unacceptable risk to construction workers. The reason for this is discussed below.

A USEPA methodology (or model) was used to evaluate lead exposures and associated risks for the construction worker as well as for the other scenarios at the LF2/SARN/38-Acre Parcel Fill Area. In order to function properly, the model requires that the construction worker be working at the site and exposed to the soils containing elevated lead levels for a minimum amount of time (for example, for 3 months, 5 days a week). In actuality, this is longer than a construction worker would normally be working at the site and exposed to the site soils containing elevated lead levels (for example, a construction worker can normally be expected to work about 5 days a week for only 1 ½ months). As a result of this longer period of time required by the model, the calculated RBRG value is lower than would be expected if a more realistic period of time could be used. Consequently, the calculated RBRG of 595 mg/kg associated with the construction worker's exposure to lead is overly conservative.

The exposure point concentration of 707 mg/kg also overestimates the construction worker's exposure to lead because construction work is an intrusive activity. As such, it is unlikely that a construction worker would only be exposed to the surficial soils (0 to 1 foot) in the area encompassed by the elevated lead levels at the LF2/SARN/38-Acre Parcel Fill Area. It is more likely that a construction worker would be exposed also to the deeper soils (which contain normal or background lead levels). For example, typical construction-related activities anticipated in the LF 2/SARN/38-Acre Parcel Fill Area include utility installation and repair (e.g., power, telephone, potable water, sprinkler systems, etc.). The depth of such intrusive activity would most likely be in the 3 to 5 foot range, rather than just at the ground surface. Thus, the exposure point concentration of 520 mg/kg for the 0 to 10 foot interval is likely more representative of potential exposures than the 707 mg/kg value.

Because potential risks associated with the construction worker's exposure to lead is overestimated both by the calculated RBRG and the surficial exposure point concentration, the calculated 0 to 1 foot value of 707 mg/kg overestimates actual risks posed to future construction workers at the LF2/SARN/38-Acre Parcel Fill Area. Therefore, the lead concentrations present at the LF2/SARN/38-Acre Parcel Fill Area do not pose an unacceptable risk to construction workers.

### **3.3 Ecological Risk Assessment**

The BRA also evaluates whether the **ecological COPCs** (ecoCOPCs) detected in the LF2/SARN/38-Acre Parcel Fill Area soil and earthworm tissue samples were present in concentrations that represented an unacceptable risk to the environment. This environmental risk assessment is called an ecological risk assessment.

The ecological risk assessment considered potential risks to earthworms, mammalian receptors (as represented by the shrew, white-footed mouse, woodchuck, and feral cat), birds (as represented by robin and Cooper's hawk), and plants. In addition, food web exposure pathways were also quantified for the robin (ingesting worms and soil), shrew (ingesting worms and soil), woodchuck and white-footed mouse (ingesting plants and soil), Cooper's hawk (ingesting small mammals and birds), and feral cats (ingesting small mammals and birds). The feral cat is evaluated as a representative of potentially occurring non-feral animals (pets) due to conversion of much of the surplused property to residential use. The ecological risk assessment compared the concentrations of the ecoCOPCs detected at the LF2/SARN/38-Acre Parcel Fill Area with environmental health based levels.

The ecological risk assessment equivalent of the human health HI is the **ecotoxicity quotient (EQ)**. As with the HI, an EQ greater than one ( $EQ > 1$ ) indicates a level of risk that is potentially unacceptable. None of the ecoCOPC concentrations in the soil samples from the LF2/SARN/38-Acre

Parcel Fill Area resulted in an EQ > 1 for the earthworm, white-footed mouse, or woodchuck for the COPCs evaluated (Table 3-5). EQs exceeded one for the potential ingestion of soil antimony and lead by the shrew and robin, respectively. Because the EQs only slightly exceed the **no observed adverse effect level (NOAEL)** for these constituents, there is a very low potential for adverse effects due to soil ingestion. The NOAEL is a conservative benchmark and it is not anticipated that significant adverse effects are actually occurring. When the **lowest observed adverse effect level (LOAEL)** is used as the benchmark, EQs less than one are the result. EQs for the exposure of plants to boron and molybdenum also exceeded one. However, considering the vegetation and wide variety of plants present at the LF2/SARN/38-Acre Parcel Fill Area, it does not appear that concentrations of molybdenum, boron, and other soil ecoCOPCs are causing significant adverse effects to plants.

The evaluation of the potential for COPCs to concentrate in animal food chains resulted in no EQs greater than one for the woodchuck, white-footed mouse, Cooper's hawk, and feral cat. EQs exceeded one for the ingestion of earthworms by robins for lead and zinc. Considering the migratory tendencies for many of the bird species at Fort Sheridan, the exposure duration at the LF2/SARN/38-Acre Parcel Fill Area would be considerably less than the 100 percent residency used in the evaluation. In addition, the ecotoxicity benchmarks used in these evaluations are the conservative NOAELs. When LOAELs are used as benchmarks, the earthworm ingestion EQs decrease to less than one. EQs also exceeded one for the ingestion of earthworms by shrews for antimony and vanadium. The ecotoxicity benchmark used for antimony is the conservative NOAEL. When the LOAEL is used as a benchmark, the earthworm ingestion EQ decreases to less than one. Because vanadium concentrations detected in samples collected at the LF2/SARN/38-Acre Parcel Fill Area are similar to concentrations detected in background samples, no adverse effects are anticipated to shrews from ingesting vanadium in earthworms.

Table 3-1. COPCs for LF2/SARN/38-Acre Parcel Fill Area Soil

Human Health COPCs	EcoCOPCs
Benzo(a)anthracene	4(2,4-dichlorophenoxy) butyric acid (2,4-DB)
Benzo(a)pyrene	Acenaphthene
Benzo(b)fluoranthene	Acenaphthylene
Beryllium	Anthracene
Indeno(1,2,3-c,d)pyrene	Antimony
Lead	Benzo(a)anthracene
Benzo(k)fluoroanthene	Benzo(a)pyrene
Chrysene	Benzo(b)fluoranthene
Dibenzo(a,h)anthracene	Benzo(ghi)perylene
	Benzo(k)fluoranthene
	Beryllium
	Bis(2-ethylhexyl)phthalate
	Boron
	Chlordane, total
	Chrysene
	Copper
	DDD, p,p'
	DDE, p,p'
	DDT, p,p'
	Dibenzo(ah)anthracene
	Dicamba
	Fluoranthene
	Fluorene
	Indeno(1,2,3-cd)pyrene
	Lead
	2-(4-chloro-2-methylphenoxy) propanoic acid (MCPP)
	Mercury
	Methylnaphthalene, 1-
	Methylnaphthalene, 2-
	Molybdenum
	Naphthalene
	Phenanthrene
	Pyrene
	Silver
	Tin

Source: QST, 1999.

Table 3-2. Summary of Potential Human Health Risks\*

Exposure Scenario	Total Noncarcinogenic Hazard Index		Total Carcinogenic Risk†	
	RAE	RME	RAE	RME
<b>Recreational Adult</b>				
Surface Soil	4E-05	2E-04	4E-05	6E-06
Subsurface Soil	3E-05	1E-04	7E-07	3E-06
<b>Recreational Child</b>				
Surface Soil	2E-04	1E-03	†	†
Subsurface Soil	2E-04	8E-04	†	†
<b>General Worker</b>				
Surface Soil	8E-05	4E-04	6E-07	3E-06
Subsurface Soil	6E-05	3E-04	3E-07	2E-06
<b>Construction Worker</b>				
Surface Soil	6E-04	3E-03	9E-08	4E-07
Subsurface Soil	5E-04	2E-03	5E-08	2E-07

\* The range of risks provided are reflective of estimated exposures to the **reasonable average exposure (RAE)** and **reasonable maximum exposure (RME)**, respectively.

† Lifetime cancer risk estimate. For the Recreational Scenario, childhood cancer risks are included in values presented for the adult.

Source: QST, 1999.

Table 3-3. Summary of Potential Human Health Risks for Background\*

Exposure Scenario	Total Noncarcinogenic Hazard Index		Total Carcinogenic Risk*	
	RAE	RME	RAE	RME
Recreational Adult				
Surface Soil	3E-05	2E-04	9E-08	5E-07
Subsurface Soil	2E-05	1E-04	6E-08	3E-07
Recreational Child				
Surface Soil	1E-04	7E-04	†	†
Subsurface Soil	1E-04	5E-04	†	†
General Worker				
Surface Soil	8E-05	4E-04	4E-08	2E-07
Subsurface Soil	6E-05	3E-04	3E-08	1E-07
Construction Worker				
Surface Soil	6E-04	3E-03	6E-09	3E-08
Subsurface Soil	5E-04	2E-03	4E-09	2E-08

\* The range of risks provided are reflective of estimated exposures to the RAE and RME, respectively.

† Lifetime cancer risk estimate. For the Recreational Scenario, childhood cancer risks are included in values presented for the adult.

Source: QST, 1999.

**Table 3-4. Comparison of Lead Concentrations in Soil with Site-Specific RBRGs**

<u>Exposure Pathway</u>		<u>Lead Concentrations*</u> (mg/kg)	<u>RBRG</u> (mg/kg)
Recreational	Adult	83.9-161	1,501
	Child	83.9-161	400
Maintenance Worker	Adult	83.9-161	1,261
Construction Worker	Adult	520-707	595

\* Values shown are for the 0 to 10 foot and 0 to 1 foot intervals, respectively.

mg/kg = milligrams per kilogram

RBRG = Risk Based Remediation Goal

Source: QST, 1999.

Table 3-5. Summary of Potential Risks to Ecological Receptors

Exposure Medium	Receptor Type	Number of Times EQ > 1	EcoCOPCs with EQ > 1	Significance
Soil	Earthworm	0/24		Results indicate soil is not chronically toxic to soil invertebrates.
	Shrew	1/34	Antimony	Slight EQ exceedence is based on NOAEL. However when a LOAEL is used, no adverse effects are anticipated to the population (EQ<1).
	White-footed mouse	0/34		
	Woodchuck	0/34		
	Robin	1/34	Lead	Slight EQ exceedence is based on NOAEL. However, when a LOAEL is used, no adverse effects are anticipated to the population (EQ<1). Consideration of animal's home range would significantly reduce the EQ further.
	Plants	2/14	Boron Molybdenum	Slight EQ exceedence is based on NOAEL. However, when a LOAEL is used, no adverse effects are anticipated to the population (EQ<1).
	Food Web	2/40	Lead Zinc	Slight EQ exceedence is based on NOAEL. However when a LOAEL is used, no adverse effects are anticipated to the population (EQ<1). Consideration of animal's home range would significantly reduce the EQ further.
	Shrew	2/40	Antimony Vanadium	Slight EQ exceedence is based on NOAEL. However when a LOAEL is used, no adverse effects are anticipated to the population (EQ<1).
	Woodchuck	0/40		Results indicate soil is not chronically toxic or significant in affecting food web exposure.
	White-footed mouse	0/40		Results indicate soil is not chronically toxic or significant in affecting food web exposure.
	Cooper's hawk	0/16		Results indicate soil is not chronically toxic or significant in affecting food web exposure.
	Feral cat	0/16		Results indicate soil is not chronically toxic or significant in affecting food web exposure.

EQ = ecotoxicity quotient.

NOAEL = no observed adverse effect level

LOAEL = lowest observed adverse effect level

Source: QST, 1999.

## 4.0 Summary of the Proposed Action

Based on the evaluation of risks considering a future recreational use scenario of the LF2/SARN/38-Acre Parcel Fill Area, the Army, in coordination with USEPA and IEPA, has determined that the constituents present do not pose significant risk to human health or the environment and recommends that no response action is necessary. Although detectable levels of mission-related constituents are present in the soil and earthworm samples collected at the LF2/SARN/38-Acre Parcel Fill Area, they are present at levels that do not and will not cause unacceptable human health or environmental effects.

Groundwater use was not an exposure pathway in the BRA because the shallow groundwater at the study areas is not currently used as a water source and will not yield enough water to support the installation of a shallow drinking or irrigation well. Furthermore, an abundant supply of **potable** water is readily available from Lake Michigan. Existing site conditions, in combination with the mandated transfer of the property to the Lake County Forest Preserve District in P.L. 104-32, will limit future use of these study areas to open space.

This recommendation is based on the RI and risk assessment. These documents are available at the information repositories listed previously.

## 5.0 Community Participation

The Army relies on public input so that the alternative selected for the LF2/SARN/38-Acre Parcel Fill Area of the Surplus OU meets the needs and concerns of the community. To ensure that the community's concerns are being thoroughly addressed, the Proposed Plan will have a public comment period from March 3, 1999 to April 1, 1999. During this time, the public is encouraged to submit comments on the Proposed Plan to the Army. The Army, in consultation with USEPA and IEPA, may modify the Preferred Alternative; select another response action; or develop another alternative, if warranted by public comments and/or presentation of substantial new information.

The public is encouraged to review and comment on the finding of No Response Action needed as presented in the Proposed Plan. Significant public comments will be included with appropriate responses in the responsiveness summary that will be included in the public record. Although the Army has recommended that no cleanup action is needed, no final decision will be rendered until all public comments have been thoroughly reviewed and evaluated. The final cleanup remedy will be documented in a Decision Document, which contains a detailed description of the final remedial action, outlines the Army's decision-making process, and thoroughly responds to community input solicited during the formal comment period.

### **Information Repositories**

An information repository containing the most pertinent information of the Fort Sheridan environmental program is located in each of the three adjoining municipalities at locations listed in Section 1.0. The full Administrative Record File is maintained at the Fort Sheridan BRAC Office, Building 379.

### **Public Comment Invited**

A public notice has been issued announcing the public information session to be held on March 3, 1999 from 8:00 pm to 9:00 p.m. in Building 900 at Fort Sheridan. The Army will present the findings of the RI and BRA, and summarize the No Response Action remedial alternative presented in the Proposed Plan. The Army will also discuss the rationale for selecting the Preferred Alternative and will be available to interested citizens who wish to ask questions and provide comments. Written public comments will be accepted at the Fort Sheridan BRAC Office until April 1, 1999.

## 6.0 References

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- USEPA. 1994. Integrated Exposure Uptake BioKinetic Model for Lead in Children (IEUBK). Version 0.99D. Office of Solid Waste and Emergency Response, Washington, District of Columbia. Program Disk: NTIS No. PB94-501517. Guidance Manual: EPA/540/R-93/081, NTIS No. PB93-963510.
- USEPA. 1989a. Risk Assessment Guidelines for Superfund: Volume I. Human Health Evaluation manual, Part A, Interim Final. Office of Solid Waste and Emergency Response. OSWER Directive 9285.7-011
- USEPA. 1989b. Risk Assessment Guidance for Superfund: Volume II. Environmental Evaluation Manual, Interim Final. Office of Emergency and Remedial Response. EPA 540/1-89/001.

## **Appendix A**

### **Glossary of Terms**

## Glossary of Terms

**Administrative Record File:** A file that contains the information used to make a decision on the selection of a response action under CERCLA. The file is established at or near a site and is available for public review.

**Background:** Naturally occurring or other non-site related levels of chemicals as distinguished from site-related chemicals.

**Baseline Risk Assessment (BRA):** The process whereby risks to human health and the environment are quantitatively evaluated under the no action scenario. This information is used to determine whether remedial actions are necessary. The BRA is conducted during the RI/FS.

**Carcinogenic:** Term used to describe chemicals or substances that are known or suspected to cause cancer in humans based on observed health effects in humans or existing data from animal laboratory tests.

**Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA):** A federal law enacted in 1980 and subsequently modified by the Superfund Amendments and Reauthorization Act of 1986 (SARA). This act resulted in the creation of a trust fund, commonly known as "Superfund," which provides money to investigate and clean up abandoned or uncontrolled hazardous waste sites.

**Constituents of Potential Concern (COPCs):** Chemical constituents that are detected at study areas and determined, through a screening process, to have the potential to present unacceptable risks to human health and the environment. These constituents are evaluated in the BRA.

**Decision Document:** A legal document that describes in detail the remedy selected for an entire site or a particular operable unit. The Decision Document summarizes the results of the RI/FS and includes a formal response to comments supplied by the public.

**Ecological COPCs:** COPCs selected in the BRA specifically because of their potential to harm animals or plants at a site.

**Ecotoxicity quotient (EQ):** An indicator of the potential for a constituent to cause adverse effects in environmental [non-human (animal or plant)] receptors. The EQ is calculated by dividing the

**ecological COPC concentration by the ecotoxicity benchmark (published exposure levels). Any result of this calculation that is greater than 1.0 is considered to represent a potentially unacceptable risk.**

**Epidemiological:** Relating to those factors that contribute to the occurrence of a disease in a population.

**Exposure Pathways:** The course a chemical constituent takes from the source to the receptor. An exposure pathway links the sources, locations, and release mechanisms (e.g., volatilization) with receptor locations and activity patterns.

**Exposure Route:** An exposure route is the way a chemical comes in contact with a receptor (e.g., ingestion, inhalation, dermal absorption).

**Feasibility Study (FS):** A study that supports the selection of a remedial action at a site. The FS identifies, develops, and evaluates several alternatives for addressing contamination.

**Food Chain:** A chain of plants and animals in a natural setting such that each link in the chain feeds on the one below and is eaten by the one above. There are seldom more than six links in a chain, with plants and bacteria on the bottom and the largest carnivores (e.g., wolves) at the top.

**Groundwater:** Water that is present in the open spaces between soil particles (silt, sand, gravel) and/or rock fractures below the ground surface.

**Hazard Index (HI):** An indicator of the potential for a chemical to cause non-carcinogenic health effects in humans. The HI is calculated by dividing maximum and average human exposure estimates to a particular chemical by exposure levels that USEPA has determined to be acceptable. Any result of this calculation that is greater than 1.0 may represent a potential unacceptable risk. Because non-carcinogenic health effects often materialize at specific body systems or organs, HIs may be calculated for the specific body systems or organs that may be affected.

**Information Repository:** A location where documents and data related to a site investigation and response actions are maintained to allow the public access to this material.

**Invertebrate:** Creatures without a backbone such as a worm or an insect.

**Lowest Observed Adverse Effect Level (LOAEL):** The lowest concentration of a chemical that can cause adverse effects to occur to a test animal. This concentration is determined in laboratory experiments.

**Metals:** In the context of the RI/BRA, the term "metals" refers to one or more of the 26 elemental metallic constituents analyzed for in Surplus OU samples. Each of these metals occurs naturally at varying concentrations and many are necessary for human life. Each of them can also be potentially toxic if present at high enough concentrations.

**Method Detection Limits (MDL):** The lowest concentration at which a given chemical constituent can reliably be detected by a given analytical method under ideal conditions in a laboratory. MDLs are chemical, analytical, and laboratory specific.

**National Oil and Hazardous Substances Pollution Contingency Plan (NCP):** A federal regulation that outlines the procedures that must be followed under the Superfund program. The NCP was most recently revised in 1990.

**Non-carcinogenic:** This term refers to health effects other than cancer and is generally used to describe the chemical constituents that produce these health effects.

**No Observed Adverse Effect Level (NOAEL):** The highest concentration of a chemical that does not cause an adverse effect to a test animal. This concentration is determined in laboratory experiments.

**Operable Unit:** An individual action that is part of the overall remedy for a particular site. This portion of the remedial response manages migration, or eliminates or addresses a release, threat of a release, or an exposure pathway. Operable units may address geographic portions of a site, specific-site problems, or initial phases of an action.

**Polynuclear Aromatic Hydrocarbon (PAH):** A group of organic chemicals formed during the incomplete burning of coal, oil, gas, wood or other combustible material. PAHs are both man-made and naturally occurring in coal, crude oil, and coal tar pitch. They have uses in dyes, plastics, pesticides and asphalt road construction.

**Potable:** Water that is suitable for drinking.

**Preferred Alternative:** The remedial alternative initially proposed for implementation as a result of the screening process conducted during the FS.

**Reasonable Average Exposure (RAE):** Central tendency estimate of exposure for a receptor group.

**Reasonable Maximum Exposure (RME):** High end estimate of exposure for a receptor group.

**Receptor:** A human, animal, or plant that could potentially receive exposure to chemicals resulting from the chemical's migration from hazardous waste sites.

**Remedial Investigation (RI):** A study that supports the selection of a remedial action at a site. The RI identifies the nature, magnitude, and extent of contamination associated with a site.

**Responsiveness Summary:** Comments presented during the public information session and received during the public comment period that are considered and addressed by the Army.

**Superfund Amendments and Reauthorization Act of 1986 (SARA):** This act modified CERCLA and resulted in the creation of a trust fund commonly known as "Superfund" which provides money to investigate and cleanup abandoned or uncontrolled hazardous waste sites.

**Total Carcinogenic PAHs:** This term refers to the sum of the detected concentration of seven known or suspected carcinogenic polynuclear aromatic hydrocarbons (PAHs). The seven PAHs are benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene, dibenzo(a,h)anthracene, indeno(1,2,3-cd)pyrene.

**Unexploded Ordnance (UXO):** Military munitions (e.g., bullets, land mines, torpedoes, bombs, etc.) that have been primed, fuzed, armed, or otherwise prepared for action and have been fired, dropped, launched, projected, or placed and remain unexploded either by malfunction, design, or any other cause.